

## SPA 3609 Tutorial 4, Questions for formative feedback

1. A silicon strip sensor 0.5 mm thick and  $10 \times 10 \text{ mm}^2$  area is lightly doped n type such that  $n_0 = 10^{13} \text{ cm}^{-3}$ . One 5 MeV alpha particle deposits all its energy in this sensor underneath a single 0.1 mm wide strip. Calculate the thermal equilibrium concentration of holes and then the concentration of electrons and holes in the region under the strip just after the alpha particle has interacted with the sensor. [Mean ionisation energy for Si is 3.6 eV]
2. In Q1 assume that the e/h pairs are produced at the silicon just under the strip (very highly ionising particles). Calculate how long will it takes to collect the signal electrons if they drift towards the substrate (opposite side) if the sensor reverse bias is 50V [You may assume that  $\mu_e = 1400 \text{ cm}^2/\text{Vs}$ ]
3. In Q1 assume that pitch (centre-to-centre repeat distance) of the strips is 0.12 mm and that we are recording a uniform beam of 1 GeV muons passing vertically through the whole area of the sensor. If we have an electronic readout which only returns the spatial location of the strip with the largest signal (binary readout) calculate the sensor resolution at right angles to the direction of the strips.